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**WARNING DEVICE AND METHOD****FIELD OF THE INVENTION**

The present invention relates to warning devices.

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**BACKGROUND OF THE INVENTION**

Many medicines and food products have an expiration date printed on packaging, which is the last date on which the product is recommended for use. These products are defined herein as products with a "single expiration date".

10 Also, there are products whose expiration date is based on two expiration mechanisms: the first one is the printed expiration date as mentioned before, and the second one is a time limit starting from the first time of opening the seal or of using the product. These products are defined herein as products with a "double expiration date". Examples of these products include: eye drops – to be used within one month from first opening, nose  
15 drops – to be used within one month from first opening, certain salad dressings – to be used within 6 weeks from first opening.

The second expiration mechanism, which is measured from the time of opening the package, is extremely problematic at present, because there is no indication of the point in time when the product expires (unlike the printed expiration date). For example, suppose that  
20 a few weeks after first use of eye drops, there's a need to use them again. It is most likely that the user cannot remember whether 3 weeks have passed from the first use, so that the product can be used, or 5 weeks have passed from the first use, so that the product must not be used.

Thus, the use of expired medicine and foods is very likely today, particularly of  
25 products with an expiration date counted from the first opening. It is also likely that people forget to check the printed expiration date. The result may be inefficient treatment, consumption of spoiled products, direct damage to consumers, and damage to manufacturers in terms of reputation and possible law suits.

### SUMMARY OF THE INVENTION

The present invention provides a compact electronic device which automatically provides an alert when the product has reached the expiration date (i.e. should be disposed of and not used). Preferably, the device is located on or inside the packaging of the product, for example, within the cap of a bottled product.

The device might be in various shapes and dimensions, and located in various options. For example: the device might be inserted within the cap of a product sold in bottles or tubes with caps. Another example: the device might have a flat shape, so that it can be attached to the packaging of the product as a sticker (adhesive label).

The device automatically provides an alert when the expiration date for the product has passed. Optionally it can provide another signal during the period in which the expiration date has not passed yet. A simple example: before the expiration date, the device activates a voice message saying: "OK TO USE." After the expiration date, the device activates a voice message saying: "EXPIRED.. EXPIRED.. EXPIRED..".

The signal activation may be accomplished by various means. One example: For a medicine sold in a bottle with a cap (e.g. eye drops), a mechanical switch might activate the signal by shorting a circuit when the cap is opened. Another example: For tablets sold in paper or plastic packaging (with no cap), a motion sensor, which can be a part of the device, identifies that the medicine has moved, thus activating the signal.

The device has several functional versions:

a. A version for products with double expiration date, which is designed to provide an alert only upon expiration of the time limit from first opening.

b. A version for products with double expiration date, which is designed to alert expiration due to either or both of the two expiration mechanisms: expiration due to time limit from first opening, or general expiration date, from the date of manufacture (the one which is usually printed on the packaging).

c. A version for products with a single expiration date (the one which is usually printed on the packaging).

The device provides an alert when the product has passed this expiration date. The alert signal may be audible or visual or both.

An audible signal might be beep sounds, tunes (music) or voice (a speaking device). A visual signal might be a constant or blinking light, or a changing visual display, as by using a chemical process, e.g. strip which changes its color after a predefined time.

5 Generally, an audible signal is preferred because the user hears it, while a visual signal might be missed, unless the user is actually looking at or for it. However, for some applications the visual signal is useful, for example, providing an alert of expiration for people with hearing problems. If desired, both an audible and a visible indication may be provided.

10 The alert signal for expiration, or the differentiation between prior to expiration and post expiration, can be achieved in several ways:

Option 1: while the product has not expired, there will be no alert. When the product has expired, there will be an alert signal. For example: continuous beep sounds when opening the cap or when picking up the product. This alert indicates that the product should be disposed of, and should not be used anymore.

15 Option 2: while the product has not expired, there will be one kind of signal. When the product has expired, there will be another kind of signal. For example, before expiration, when opening the cap or when picking up the product, there will be a beep sound each 5 seconds, or a voice saying "ok to use". After expiration - when opening the cap or when picking up the product, there will be continuous loud high-rate alert beep sounds or a voice  
20 saying "expired ... expired ... expired". It will be appreciated that, if the device malfunctions for some reason (e.g. the battery is dead), and there is no signal at all, this will also mean that the product has expired, and should not be used.

Option 3: while the product has not expired, there will be some kind of signal. For example: a short melody (tunes) when opening the cap or when picking up the product.  
25 When the product has expired, there will be no signal at all. The absence of a signal indicates that the product should be disposed, and shall not be used anymore.

Option 1 is least desirable, because if the device malfunctions for some reason (e.g. the battery is empty), the user might think that the product has not expired, and may be used. Preferably, the product will be designed to include a battery whose life is longer than the  
30 product's shelf life, so that this should not happen. Option 2 and option 3 are preferred,

because there must be a signal indicating the product can be used. If there is no signal, the product should be considered as expired, thus disposed.

The device is very low cost, thus the device can be disposed of with the disposed product or packaging. The device is also extremely simple to use: it operates automatically.

5 No special user activation or setup whatsoever is required. Rather, the device is factory set for its specific product.

There is thus provided, in accordance with the present invention, a warning device to be attached to packaging of any product which has an expiration date, the device including timer means for counting passage of a pre-set period of time, according to a timing program  
10 tailored for the product, to the expiration date, and for providing a signal at the expiration date, an indicator arranged to receive said signal and to provide an indication to differentiate a pre-expiration date period from a post-expiration date period, and a switch coupled to the packaging and arranged to activate the indicator when a person attempts to use the product. According to one embodiment, the device includes means for counting passage of a factory  
15 pre-set period of time from manufacturing date, according to a timing program tailored to a selected product, and an indicator for providing an indication to differentiate the pre expiration period from the post expiration period.

According to an alternative embodiment, the device includes means for counting passage of a pre-set period of time from the date of first opening of the product packaging by  
20 consumer, according to a timing program tailored to a selected product, and an indicator for providing an indication to differentiate the pre expiration period from the post expiration period.

According to a preferred embodiment, the device includes a printed circuit board (PCB) with a chip-on-board having a dedicated timing program for providing signals in  
25 accordance with the timing program, an in-factory activated trigger for activating a timing countdown from date of manufacture, a signaling device, such as a speaker, an automatically activated switch for activating the signaling device whenever the product packaging is opened, or whenever the user attempts to use the product, and an internal power source, such as a battery, for powering the device.

30 According to another preferred embodiment, the device includes a printed circuit board (PCB) with a chip-on-board having a dedicated timing program for providing signals

in accordance with the timing program, an automatically activated switch for activating the timing countdown from product's first opening by consumer, a signaling device, an automatically activated switch for activating the signaling device whenever the product packaging is opened, and an internal power source for powering the device.

5            Preferably, the device is designed for the life span of the related product, so that battery replacement will not be needed.

          As mentioned before, the use of audible tones (beeps, melody, voice) as a signal can be replaced with light, i.e. using a visual signal instead of a sound signal. For example, this can be a constant light or a blinking light. This solution maintains the same low cost and  
10 functional simplicity of the device. This solution is good for people with hearing difficulties, as well as for people who prefer a silent device. The operation is based on the same principle: when the consumer opens the product packaging or attempts to use the product (medicine, food), blinking lights appear, indicating whether the product has expired (e.g., blinking red light) or not expired (e.g., blinking green light). It is also possible to combine both a visual  
15 and an audible indication for the same product.

          There is also provided in accordance with the invention, a method for providing a warning for a product which has an expiration date. The method includes coupling to the product packaging timer means for counting passage of a pre-set period of time, according to a timing program tailored to the product, to the expiration date; and an indicator for  
20 providing an indication to differentiate a pre-expiration date period from a post-expiration date period. The method further includes triggering the timer means to automatically begin counting passage of the pre-set period of time, and automatically activating the indicator after passage of the pre-set period of time.

### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further understood and appreciated from the following detailed description taken in conjunction with the drawings in which:

**Fig. 1a** is a sectional view of packaging including a warning device constructed and operative in accordance with one embodiment of the present invention;

**Fig. 1b** is an enlarged front view of the subassembly marked as detail A of the device of **Fig. 1d**;

**Fig. 1c** is an isometric view of the subassembly of **Fig. 1b**;

**Fig. 1d** is an exploded view of the packaging of **Fig. 1a**;

**Fig. 1e** is an isometric view of the subassembly marked as B in **Fig. 1d**;

**Fig. 2a**, is an exploded view of a device constructed and operative in accordance with another embodiment of the present invention;

**Fig. 2b**, is an isometric view of the same assembly;

**Fig. 2c**, is an isometric partial view of the same assembly;

**Fig. 3** is a flow chart of operation of a device constructed and operative in accordance with one embodiment of the present invention;

**Fig. 4** is a flow chart of operation of a device constructed and operative in accordance with another embodiment of the present invention;

**Fig. 5** is a flow chart of operation of a device constructed and operative in accordance with a further embodiment of the present invention;

**Fig. 6** is a flow chart of operation of a device constructed and operative in accordance with yet another embodiment of the present invention;

**Fig. 7** is a flow chart of operation of a device constructed and operative in accordance with a further embodiment of the present invention;

**Fig. 8** is a flow chart of operation of a device constructed and operative in accordance with yet another embodiment of the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a compact electronic warning device, preferably located on or inside the packaging of a product having an expiration date, such as medicines or foods. This device automatically provides an alert when the expiration date of the product has passed (i.e., when the product should be disposed of and not used). Devices according to the invention may be used for indicating expiration time after which the product is less good or less safe to use or not good at all or not safe to use at all or strictly forbidden to use. They may be used on products which have expiration dates due to safety reasons, due to functional reasons, or for any other reason. The warning device according to the invention includes timer means for counting passage of a pre-set period of time, according to a timing program tailored for the product, to the expiration date, an indicator for providing an indication to differentiate a pre-expiration date period from a post-expiration date period, and a trigger or switch to cause the timer means to start a countdown from the manufacturing date, or from the first opening date, or both independently.

The electronic unit preferably includes the following components:

- a. A printed circuit board assembly (PCB), preferably with a Chip-On-Board, that is responsible for time measuring, based on a factory preset timing program (internal programming), and for sending signals to a signaling means. The PCB can be standard epoxy-glass, or a new generation printed circuit – which uses an inexpensive, thin, possibly flexible base, such as paper or some type of polymer, or any other PCB. The thin PCB option is particularly suitable for designing a device in the shape and size of an adhesive label.
- b. Signaling or indicator means, such as piezo speaker (a very thin speaker) or another type of speaker, or a steady or blinking light, such as a LED or Micro Bulb, or any other small size signaling means.
- c. A switch or trigger to activate the signaling means when the user opens the packaging or attempts to use the product. In the case of a product in a bottle with a cap, the trigger can be a mechanical switch, activated by opening the cap. In the case of a product, such as tablets, in a paper box, the trigger can be a motion sensitive component. Alternatively, any other suitable trigger can be utilized, for example, a sensor to sense the sound made when a user extracts a pill from a blister pack.

d. When the product has an expiration date counted from the manufacturing date, there is provided a switch or trigger which is activated in the factory at the time of manufacture, thus activating countdown. It will be appreciated that the "trigger" can, in effect, be installation of the battery or any other process during manufacture or assembly, with no separate switch or other element required.

e. In addition or instead, when it is desired to identify an expiration date a pre-defined time after the first opening, there is provided a switch or trigger which identifies the first opening of the product, and activates countdown. In the case of a product in a bottle with a cap, the trigger can be a mechanical switch, activated by opening the cap. According to one embodiment, the trigger is the same mechanism mentioned at the previous paragraph (c), having a dual function: i.e. it activates the signaling at every cap opening, and it also activates the countdown at the first opening. Alternatively, this trigger can be a different switch, possibly connected to a seal on the cap, and activated when tearing off the seal. If the device is a kind of adhesive label, the triggering may be activated as a part of tearing the seal with the first opening.

f. A power source, preferably a small battery, such as a 1.5 Volt LR41 or LR 1130, or any other inexpensive small cell. A very thin battery is preferably when the device is designed in the shape and size of an adhesive label. Some existing new technologies, such as "Power Paper" may be considered.

The device has several functional versions:

a. A version for products having two expiration dates, but which is designed to alert only at the expiration of the time limit from the first opening. In this case, the countdown is activated from the moment the consumer first opens the product.

b. A version for products with two expiration dates, which is designed to provide an alert at the expiration of a time limit according to either of the two expiration mechanisms: expiration due to time limit from first opening, or general expiration date, from manufacturing (which is usually printed on the packaging). In this case, there are two independent countdowns: one countdown is activated from the moment the consumer first



opens the product, and the second countdown is activated by the manufacturer, as a part of the manufacturing process.

c. A version for products with a single expiration date from the date of manufacture (which is usually printed on the packaging). The device provides an alert when the product  
5 has passed this expiration date. In this case, the countdown is activated by the manufacturer, as a part of the manufacturing process.

The invention can be applied in various embodiments, a few of which will now be described by way of non-limiting examples.

Referring now to Figs. 1a and 1d, there are shown sectional and exploded views,  
10 respectively, of a product having an expiration date packaged with a warning device constructed and operative in accordance with one embodiment of the present invention. Figs. 1b and 1c are enlarged perspective and front views of the subassembly marked as detail A in Fig. 1a, respectively. Fig. 1e shows an isometric view of the subassembly marked as B in Fig. 1a.

15 The packaging 10 shown in Fig. 1 includes a bottle 12 having a cap 14. The bottle 12 contains the medicine or food product 10. An example of a medicine would be eye drops, while an example of a food product would be salad dressing. An expiration warning device constructed and operative in accordance with one embodiment of the present invention is assembled within the cap 14, and includes a plastic adapter 16, a plastic base 26, a pin 24,  
20 and the electronics. The electronics consist of a printed circuit board (PCB) 22, a chip 28, such as a Chip on Board, a metallic spring 29, 30, 31, a battery 32, a contact 34, a speaker 18, and a speaker housing 20. The chip 28 is located on the board 22. The contact 34 is shown here as a small sheet metal part in "L" shape, soldered to the PCB 22. The spring 29,30,31 in the illustrated embodiment is another sheet metal part, which has a dual function.  
25 A. At one end 29, it serves as a battery housing, as it is attached to the PCB 22, and holds the battery 32 in place. B. At its other end 31, it serves as a switch, as it touches the contact 34 when the pin 24 is in a down position, and it does not touch the contact 34 when the pin 24 is in an up position. The spring mid part 30 is a 90° twisted transition area, because parts 29 and 31 of the spring must be perpendicular in order to function.

30 The pin 24 is placed in a hole in the base 26. The PCB assembly is inserted into tracks 25, 27 in the base 26, so that the pin 24 is located underneath the spring 31.

The adapter 16 places and holds the base 26 in place within the cap 14. The adapter 16 also places the speaker housing 20 in its place, adjacent to the cap, centered to the small hole in the cap 17. The speaker 18 is located in the speaker housing 20, and wired to the PCB 22.

5           When the cap 14 is screwed on the bottle 12, the pin 24 is pushed, and lifts the spring 31. As a result, there is no contact between the spring end 31 and the contact 34. This is a "switch off" position. When the cap 14 is opened (for the purpose of consuming the contents of the bottle 12), the pin 24 releases spring 31, which returns to its non-tensed position contacting the contact 34. This shorts the circuit and switches on the indicating means.  
10          Whenever the switch is on, a signal is sent to the speaker. The type of signal depends on the time from first opening of the product. For example, suppose that expiration time is 30 days from first opening, the signal will be a beep each 4 seconds before 30 days have expired, and continuous annoying beeps after 30 days have expired.

          In this embodiment, it is the same switching mechanism (pin 24, spring 31, contact  
15       34) which activates both the signaling to the speaker (each time there is "switch on") and the start of countdown from the first time of opening the cap (the first time there is "switch on", i.e., the user opens the cap). In other embodiments, the countdown trigger may be activated differently, not with a dual purpose switching mechanism as here, but with a separate activation device. This would mean an extra switching or triggering mechanism, yet the chip  
20       design might be less expensive. An example of a separate triggering for first time activation and for every cap-open signaling is described in the following embodiment.

          Referring now to **Figs. 2a and 2b**, there are shown an exploded view and an isometric view, respectively, of a warning device constructed and operative in accordance with another embodiment of the present invention. **Fig. 2c**, shows another isometric view, similar to **Fig.**  
25       **2b**, but with the cover part 102 removed.

          Warning device 80, as shown in **Fig. 2a, 2b, and 2c**, refers to a label-type device. This means that the device is thin, and includes an adhesive tape 82 at its bottom. This embodiment is flat, but a non-flat and/or flexible design is also possible, to fit the shape of various products' packaging. The printed circuit board 88 can be a standard epoxy glass  
30       or a thin new technology PCB (made of paper or other material), or any other type of PCB. The adhesive tape 82 is attached to the bottom of the PCB 88. A thin cell battery

94 is attached to the PCB by means of the battery housing 96. A cell battery might be replaced with new technology power source, such as "power paper", for size minimizing. The chip on board 92 performs the countdown, as well as sending signals to the speaker 98.

5           This embodiment includes a sensor 90 as the switch mechanism to start the signaling. Sensor 90 may include a motion sensitive component. A non limiting example of a motion sensitive component is a small (typically a 3mm x 2mm x 1.5 mm size) component, with two leads. The component shorts the two leads when moved, shaken or flipped, due to a small moving inertial element within its packaging. The motion sensor is  
10 preferably soldered to the PCB 82. Thus, the motion sensor shorts a circuit whenever the product with the device is being moved, and the chip starts sending signals to the speaker. This means that the speaker 98 provides signals when a consumer lifts or opens the packaging or attempts to take a medicine. Another example of a sensor 90 is a sound sensor which identifies sound or sound frequency of extracting a pill from a blister pack.  
15 Yet another example is a strain sensor (strain gauge) which identifies deformation of a blister pack. Another alternative is a sensor that identifies changes in the overall electrical resistance in the blister pack foil, or any other physical characteristics of a medicine pack.

          The type of signaling depends on the countdown process (i.e., depending on whether it is a pre expiration point in time, or a post expiration point in time). The  
20 definition of the point in time when the countdown begins is achieved by a trigger 84, which is protected by a plastic or paper strip (tape) 86. The trigger 84 is a metal part assembled on the PCB 88. It is designed to short a circuit between printed leads 87 and 89. Until activation, the tape 86 is located between the trigger 84 and the leads 87 and 89. This means that the device has not been activated yet, and countdown has not started.  
25 Once the tape 86 is pulled out, trigger 84 activates the device.

          If this embodiment is used for a device which is designed to provide an alert regarding expiration from the manufacturing date, the tape (strip) 86 should be removed in the factory, and the countdown starts at approximately the manufacturing date.

          If this embodiment is used for a device which is designed to provide an alert  
30 regarding expiration as measured from the first time the product is opened, the tape (strip) 86 should be removed by the consumer, as a part of first time opening the product.

This can be achieved automatically if the strip 86 is attached (e.g. glued) to a seal of the product (not shown in the figure) or other packaging element which is moved when the product is opened. When the consumer tears the seal or moves the element, the strip 86 which is attached to an element of the seal or packaging element will be extracted together therewith, thus the countdown will start.

If the device is designed for dual countdown functionality, both from manufacturing and from first use, the device might include two independent triggers. This means that there will be two separated arrangements of a trigger 84 attached to two leads 87, 89 and an isolating strip 86 in between the trigger and the leads. (Not shown in the figure). One of them will be activated in the factory (by pulling its strip), therefore starting the countdown from manufacturing date. The other will be attached to the seal or other packaging element of the product, and will be activated when tearing the packaging, thus activating the second, independent, countdown from first opening the product.

The cover 102 is designed to cover the inner structure of the device. In this embodiment the cover 102 and the speaker housing 100 are separate parts, but in another embodiment they both might be a single part.

Referring now to Figs. 3, 4, 5, 6, 7, and 8, there are shown flow charts of the operation of the device, constructed and operative in accordance with various exemplary embodiments of the present invention. Each of these flow charts or methods of operation may be used in any of the examples above, or other applicable embodiments.

Fig. 3 refers to a device which is designed to indicate only expiration from first opening, e.g. for a medicine which should not be used if 30 days from first opening have expired, wherein signals or an indication are provided after the expiration date of the product. When opening the cap for the first time, it triggers the countdown, so that the chip starts timing the 30 day period (block 40). The triggering may be achieved by various triggering and/or switching mechanisms, as explained above. Optionally, there might be a special indication, such as a distinguishing sound, to indicate that the product has been opened for the first time. It might be a sequence of 3 beep sounds, for example (block 42).

This is a kind of electronic seal-opening or tamper indication: the consumer knows from this

indication that this is the first opening. If using a speaking device instead, the signal may be the words: "First open".

Starting this moment, any time the cap is open (block 44) and 30 days have not expired yet (block 46), then there will be no alert signal. When the cap is closed (block 50) and later reopened (block 44), then again, as long as 30 days have not expired (block 46), there will be no alert signal.

During this period, when the expiration date has not been reached, and there is no alert signal, the device may not provide any signal at all. This is a straight forward design approach, but it has a severe disadvantage: If the device malfunctions, the consumer assumes that the product has not expired, because there is no signal at all. For this reason, it is preferable to provide some kind of indication also when the product has not expired, for example, a beep sound every 4 seconds (block 48). Of course, the signal stops when the user closes the cap (block 52).

When opening the cap (block 44), and if 30 days from first opening have passed (block 46), then the device makes an alert sound, for example, continuous beep sounds. When closing the cap (block 56), the alert stops (block 58). The consumer should throw away the product. However, if the consumer does not dispose of the product, and attempts to use it again sometime (block 60), the alert sound will signal again (block 54). Of course, if the user keeps the expired product for a very long time, eventually the battery will become empty. If the battery is dead and the device does not function, the user should dump the product as well. This explains why the use of blocks 48, 52 (signaling for a non-expired product) is recommended. To summarize: It is safer to have two types of signaling: A signal for a pre-expiration period (might be a beep each 4 seconds or a voice saying: "ok to use"), and a different signal for a post-expiration period (might be continuous loud high-rate beep alert, or a voice saying "expired ... expired ... expired...").

While Fig. 3 refers to "switch on" as a cap open, and "switch off" as a cap closed, it is appreciated that switching the signaling means can be achieved by various switching types, suited to the type of product and its packaging. For example, the switching may be activated by a motion sensor, as explained in the adhesive label embodiment. In this case, the signal starts once the sensor identifies a package opening or movement of the product or extraction

of a pill from a blister pack, and the signal lasts as long as the motion is identified plus, say, 10 seconds.

While Fig. 3 refers to beep sounds as signals, the signals may be voice, blinking light, or any other indication.

5       The flow chart of Fig. 4 shows an alternative approach of operation of the device. In the embodiment of Fig. 4, the signals indicate that the product has not expired, while the absence of signals indicates that the product has expired. As in Fig. 3, Fig. 4 also refers to a device which is designed to indicate only expiration from first opening, e.g. a medicine which should be disposed of when 30 days from the first opening have expired.

10       When opening the cap for the first time, the countdown is triggered, so that the chip starts timing the 30 day period (block 40). Optionally, there might be a special sound, or other special indication, to indicate that the product has been opened for the first time. It might be a sequence of 3 beep sounds, for example (block 42).

15       Starting this moment, as long as the cap is open (block 44) and 30 days have not expired yet (block 46), then there will be an indication or signal, indicating the product can be used (block 62). The indication may be a beep sound each 4 seconds, or a voice saying "ok to use", or a green light, etc. When the cap is closed (block 64), the signals stop (block 66). When the cap is reopened (block 44), and as long as 30 days have not expired yet (block 46), this indication will be provided (block 62).

20       When opening the cap (block 44), and if 30 days from first opening have passed (block 46), then the device will make no signal at all. The absence of the signal indicates the user must throw away the product, and not to use it.

25       Fig. 5 refers to a device which is designed to indicate only expiration from manufacturing date, e.g. a medicine which should be disposed of 365 days after manufacturing. (e.g. manufacturing date January 01, 2004 and expiration date January 01, 2005). Since the countdown is activated in the factory by the manufacturer, no triggering is required upon first opening. However, optionally a special signal might be provided upon first opening of the product (block 42). This could provide a kind of electronic tamper indication.

30       The rest of this flow chart is similar to Figure 2, and has the same reference numerals, with one difference: instead of countdown from first opening (Fig. 2 block 46), here the

countdown is since manufacturing (block 47). The rest is the same, regarding pre expiration signaling (blocks 48, 50, 52), and post expiration signaling (blocks 54, 56, 58, 60).

Fig. 6, like Fig. 5, refers to a device which is designed to indicate only expiration from manufacturing date. Again, countdown is activated in the factory by the manufacturer, and no triggering is required when first opening the packaging. The 3 beep sound indicating first opening is a possible option (block 42). As long as the cap is open (block 44) and 365 days have not expired yet (block 47), then there will be a signal, thereby indicating that the product can be used (block 62). The signal may be a beep sound each 4 seconds, or a voice saying "ok to use", or a green light, etc. If the cap is closed (block 64), the signals stop (block 66). When the cap is reopened (block 44), and as long as 365 days have not expired yet (block 47), the indication that it is safe to use the product (block 64) will be provided again.

When opening the cap (block 44), and if 365 days from first opening have passed (block 47), then the device will make no signal at all. The absence of the signal indicates the user should throw away the product, and not to use it.

Fig. 7 refers to a device having dual expiration monitoring. This means that two independent countdowns occur. One countdown is started by the manufacturer, in the factory (for counting the general expiration period). The second countdown (block 40), starts at the moment of first opening the cap (or when tearing a seal). This is the countdown for expiration from opening. Basically, Fig. 7 is similar to Fig. 3, with one difference. In the Fig. 7 embodiment, the differentiation between pre expiration signaling (blocks 48, 50, 52) and post expiration signaling (blocks 54, 56, 58, 60) is decided based on two questions, referring to the two independent countdown processes. The questions are: Has the product expired due to ending the countdown from the manufacturing date (block 47) and: Has the product expired due to ending the countdown from first opening (block 46). (While in Fig. 3 embodiment, the differentiation between pre expiration signaling (blocks 48, 50, 52) and post expiration signaling (blocks 54, 56, 58, 60) is decided based on one question only (block 46)). So, Fig. 7 is based on two independent countdowns, while Fig. 3 is based only on one.

Fig. 8, like Fig. 7, refers to a device having dual expiration monitoring. In all other ways, it is similar to Fig. 4, but again, with one difference: It refers to two countdown processes, thus the two questions (block 46, block 47) need to be answered. If the answer is

no to both questions, there will be a signal (block 64). If the answer is yes to any of the questions (or to both of them), there will be no signal (block 68) in this embodiment.

It will be appreciated that the configuration of the switching / activating / triggering mechanisms, the PCB, the chip, etc. is not limited to those illustrated, because the electronics, and the mechanics (if any), can be implemented in various simple manners, and may be based on many types of existing technology and/or components used in many electronic consumer products. The device of the invention combines inexpensive electronics with a functional timing program that is for a specific product's expiration monitoring activity, and combining them in a functional packaging which can fit the consumed product's packaging. Together, the result is an effective and innovative high-tech aid. It has a very high benefit to cost ratio, which makes it disposable. It also has a very high ratio of benefit to simplicity of use, which makes it extremely useful and user friendly, as it is totally automatic, requiring no user setup, and it solves a real need that has not been solved until now.

As demonstrated in the various embodiments, different types of switching may be used: mechanical contact switch, motion sensitive switch, or any other suitable switch. Another option would be to use a light sensitive sensor (a standard component that closes a circuit when exposed to light). In this case, for example, opening a bottle's cap will expose the sensor to light, thus activating the indicator. This solution is less useful, because taking medicine in insufficient lighting will prevent proper functioning of the device. However, the use of light sensor is mentioned here to illustrate the variety of technical solutions for the device. It will also be appreciated that with a specific electronics / chip design, the same switching element may both activate countdown from first opening and activate signal sending whenever the product is reopened. It will also be appreciated that besides the chip, other electronic parts may be included in the PCB assembly of some possible embodiments, such as resistors or capacitors. This is a trivial matter of a PCB assembly design, thus not detailed here. It will be appreciated that the post expiration and /or pre expiration signal may be audible or visual. Audible signals might be beep sounds, tunes (music) or voice (speaking device). Visual signals might be a constant or blinking light, or a strip which changes its color after a predefined time. Using a changing color strip may involve a chemical device, with no PCB, no battery, and no electronics at all.



A special feature of the invention is that the special signaling at the time of the first opening mentioned in some of the embodiments can be considered as an "electronic" seal, indicating the lack of tampering. Thus, it may be used to replace the conventional "physical" seal in some products, and save some production costs.

5 It will be appreciated that the indicator stops providing a signal automatically after the product is put down or returned to its packaging (e.g., a bottle cap is closed). Alternatively, the indicator may provide a signal which stops automatically after a pre-set signal time.

10 The method of a typical use will now be described by way of several non-limiting examples.

Example 1: A device with expiration alert from first opening, based on Fig. 3 flow chart

- a. August 1, 2004: The consumer buys eye drops, instructions are to use within a month from first opening.
- 15 b. August 2, 2004: User A opens the bottle for the first time. 3 beep sounds declare the first opening. As long as user A uses the product, the cap provides a single beep sound each 5 seconds. When closing the cap on the bottle, the sound stops.
- c. August 10, 2004: User B finds the eye drops in the medicine closet, and wants to use it. She doesn't know when it was first opened. User B opens the cap. Since 30 days has not passed yet, there is NO alert. There is only a single beep sound each 5  
20 seconds. User B now knows that the product has not expired, thus she uses the eye drops. When closing the cap on the bottle, the sound stops.
- d. August 22, 2004: User A needs to use the product again. It's been quite a long time and user A cannot remember whether a month has passed since he'd first opened the bottle, or not. User A opens the cap. He hears a single beep sound each 5 seconds.  
25 He knows that the product is valid, and uses it. When closing the cap on the bottle, the sound stops.
- e. September 7, 2004: User A needs to use the product for the third time. Again, he cannot remember whether a month has passed since he first opened the bottle, or not. He opened the cap. The cap provides a loud continuous alert sounds in a rate of 4  
30 beeps per second. User A knows that the product has expired and must not be used. He does not use it. He closes the bottle and the alert sound stops.

- f. September 20, 2004: User B needs to use eye drops again. She finds the same bottle in the medicine cabinet. Apparently, user A has forgotten it there, and not disposed of it. User B opens the cap. Again, the cap provides a loud continuous alert sounds in a rate of 4 beeps per second. User B closes the cap without consuming the product. The alert sound stops. User B throws away the product.

Example 2: A device with expiration alert from manufacturing date, based on Fig. 5 flow chart.

- a. August 2004: The consumer buys a bottle with Paracetamol tablets, instructions are to use by December 2005.
- b. September, 2004: User A opens the bottle for the first time. As long as user A uses the product, the cap provides a voice message each 5 seconds: "ok to use" "ok to use"... etc.. He takes a pill. When closing the cap on the bottle, the voice stops.
- c. March, 2005: User B finds the Paracetamol in the medicine closet, and wants to use it. She opens the cap. There is a voice message each 5 seconds: "ok to use". User B now knows that the product has not expired, thus she takes a pill. When closing the cap on the bottle, the voice stops.
- d. February, 2006: User A needs to use the product again. He opens the cap. He hears a continuous voice message saying "EXPIRED ... EXPIRED ... EXPIRED". He doesn't use the product. When closing the cap on the bottle, the sound stops.
- e. October, 2006: User B needs to use the product again. She finds it in the cabinet. Apparently, user A has forgotten it there, and not disposed of it. User B opens the cap. The cap provides no sound whatsoever, because the battery has run out. User B knows anyway that the product should be disposed, because she doesn't hear the repetitive each 5 seconds message "ok to use". She throws away the product to the garbage.

Example 3: A device with dual expiration alert: from first opening, and from manufacturing, based on Fig. 8 flow chart

- a. August 1, 2004: The consumer buys nose drops, instructions are to use within a month from first opening, and the general expiration date is August 1, 2005.

- b. September 1, 2004: User A opens the bottle for the first time. 3 beep sounds declare the first opening. As long as user A uses the product, the cap provides a short 3 seconds melody tunes each 6 seconds. In addition, the cap provides a green light. When closing the cap on the bottle, the tunes stop, and the light turns off.
- 5 c. September 5, 2004: User B finds the nose drops in the medicine closet, and wants to use it. She doesn't know when it was first opened. User B opens the cap. Since 30 days has not passed yet, AND since the general expiration date from manufacturing has not passed yet, there is NO alert. There is only that combination of a melody and a green light. User B now knows that the product has not expired, thus she uses the
- 10 nose drops. When closing the cap on the bottle, the sound and light stop.
- d. March 22, 2005: User A needs to use nose drops. He opens the bottle. The general expiration date has not passed yet, BUT the expiration from opening has passed. There is neither sound nor light. The absence of the signals means that the product has expired.

15

Example 4: A device with expiration alert from first opening, based on Fig. 7 flow chart.

- a. August 1, 2004: The consumer buys pills, instructions are to use within 10 days from first opening. (For example, the product is sensitive to humidity). The pills packet is sealed in an aluminum foil bag, preventing humidity from reaching the medicine. The
- 20 alert device, in a label configuration, is attached to the pills packet.
- b. August 2, 2004: User A tears the aluminum bag and pulls out the packet. The label is attached to the packet, but the triggering strip is attached to the aluminum bag. Therefore, the strip is extracted from the label and countdown starts. 3 beep sounds announce the first opening. As long as user A moves the product, the label provides a
- 25 single beep sound each 5 seconds. A few seconds after putting the product down, the sound stops.
- c. August 8, 2004: User A wants to take a pill. He picks up the packet. The label's motion sensor detects the movement, thus sending a signal to the label's speaker. Since 10 days has not passed yet, there is NO alert. There is only a single beep sound
- 30 each 5 seconds. It stops a few seconds after putting down the packet.

d. August 15, 2004: User A wants to take a pill. He picks up the packet. The label's motion sensor detects the movement, thus sending a signal to the label's speaker. Since more than 10 days have passed from first opening, the label provides a loud continuous alert sounds in a rate of 4 beeps per second. User A knows that the product has expired and must not be used.

5 While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made. It will further be appreciated that the invention is not limited to what has been described hereinabove merely by way of example. Rather, the  
10 invention is limited solely by the claims which follow.

### CLAIMS

1. A warning device for attachment to packaging of a product which has an expiration date, the device comprising:

timer means for counting passage of a pre-set period of time, according to a timing  
5 program tailored to the product, to the expiration date, and for providing a signal at the expiration date;

an indicator arranged to receive said signal and to provide an indication to differentiate a pre-expiration date period from a post-expiration date period; and

a switch coupled to the packaging and arranged to activate said indicator when a  
10 person attempts to use the product.

2. The device according to claim 1, wherein said timer means includes timer means for counting a factory pre-set period of time from a manufacturing date until the expiration date.

3. The device according to claim 1 or claim 2, wherein said timer means includes  
15 timer means for counting a pre-set period of time from a date of first use until the expiration date.

4. The device according to claim 3, further comprising a trigger to cause said timer means to start a countdown from a date of first opening the product.

5. The device according to any of claims 1 to 4, wherein an indication signal is  
20 provided during a post-expiration date period, and no signal is provided during a pre-expiration date period.

6. The device according to any of claims 1 to 4, wherein an indication signal is provided during said pre-expiration date period, and no signal is provided during said post-expiration date period.

25 7. The device according to any of claims 1-4, wherein one kind of indication signal is provided during said pre-expiration date period, and another kind of signal is provided during said post-expiration date period.

8. The device according to any of the preceding claims, wherein said timer means and said indicator are electronic means.

30 9. The device according to any of the preceding claims, wherein said indicator provides an audible indication.

10. The device according to any of the preceding claims, wherein said indicator provides a visual indication.

11. The device according to any of the preceding claims, wherein said switch includes a mechanical switch.

5 12. The device according to any of claims 1-10, wherein said switch includes an electronic switch.

13. The device according to any of claims 1-10, wherein said switch includes a sensor.

10 14. The device according to either of claims 1 and 2, and comprising:  
a printed circuit board (PCB) with a chip-on-board having a dedicated timing program for providing signals in accordance with the timing program;  
an in-factory activated trigger for activating a timing countdown from date of manufacture;  
an automatically activated switch for activating said indicator whenever the product is  
15 used; and  
an internal power source for powering the device.

15. The device according to either of claims 3 or 4, and comprising:  
a printed circuit board (PCB) with a chip-on-board having a dedicated timing program for providing signals in accordance with the timing program;  
20 an automatically activated trigger for activating a timing countdown from the product's first use;  
an automatically activated switch for activating said indicator each time the product is used; and  
an internal power source for powering the device.

25 16. A method for providing a warning for a product which has an expiration date, the method comprising:  
coupling to the product packaging  
timer means for counting passage of a pre-set period of time, according to a  
timing program tailored to the product, to the expiration date; and an  
30 indicator for providing an indication to differentiate a pre-expiration date period from a post-expiration date period;

triggering said timer means to automatically begin counting passage of said pre-set period of time, and

automatically activating said indicator each time the product is used to differentiate pre-expiration from post-expiration.

5        17.     The method according to claim 16, wherein said pre-set period of time is a factory defined product expiration time from manufacturing date.

18.     The method according to claim 16, wherein said pre-set period of time is a product expiration time from a first opening of the product packaging.

10       19.     The method according to claim 16, wherein said pre-set period of time is a factory defined product expiration time from manufacturing date, or a product expiration time from a first opening of the product packaging, whatever happens first.

20.     The method according to any of claims 16-19, wherein the indicator provides a special signal at a time of a first opening, which acts as tamper evidence.

15       21.     The method according to any of claims 16-19, wherein said indicator provides a signal which starts automatically when said product is used, and stops automatically when said product is put away.

22.     The method according to any of claims 16-19, wherein said indicator provides a signal which starts automatically when said product is used, and stops automatically after a pre-set signal time.

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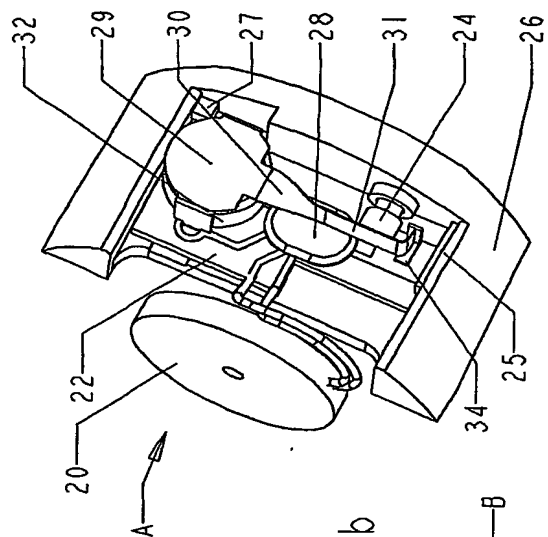


FIG. 1c

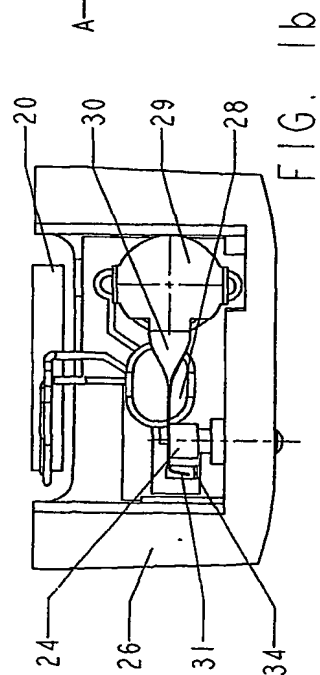


FIG. 1b

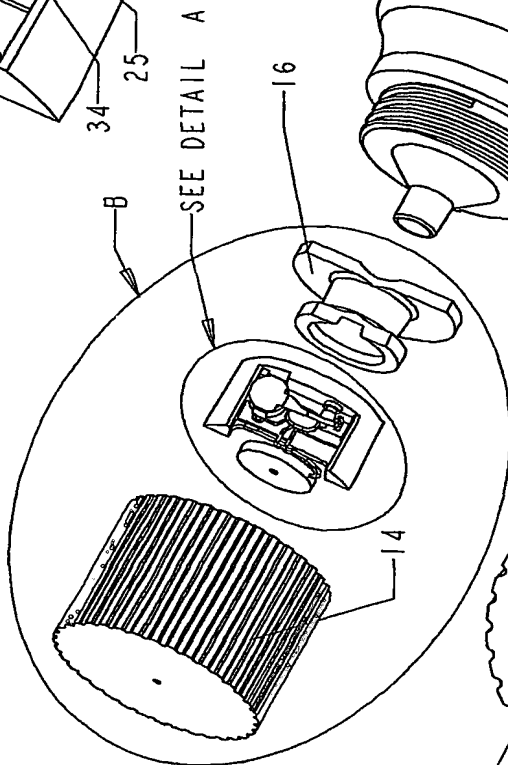


FIG. 1d

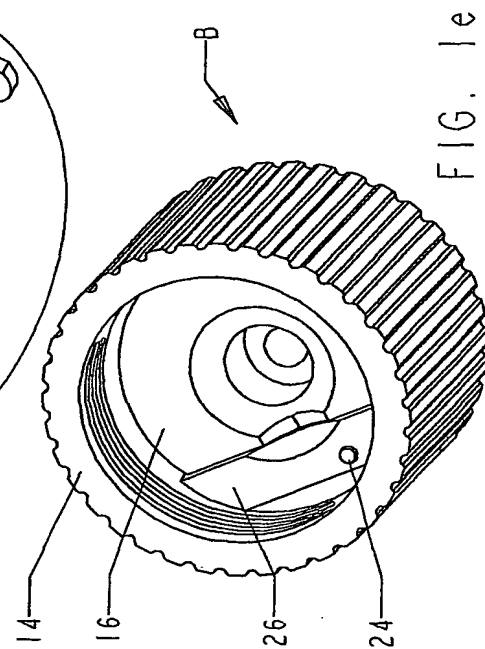


FIG. 1e

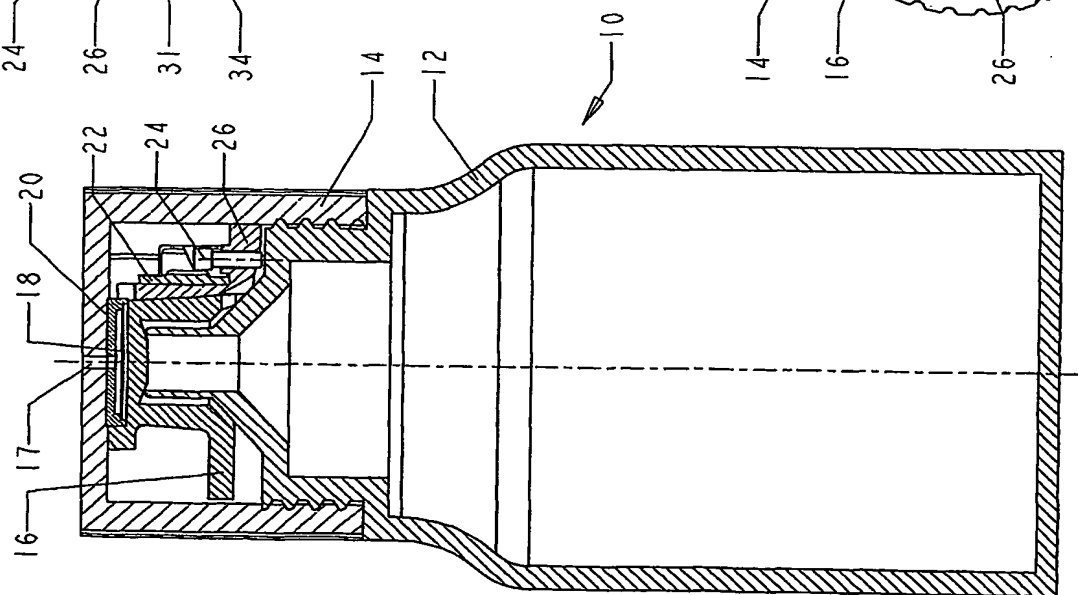
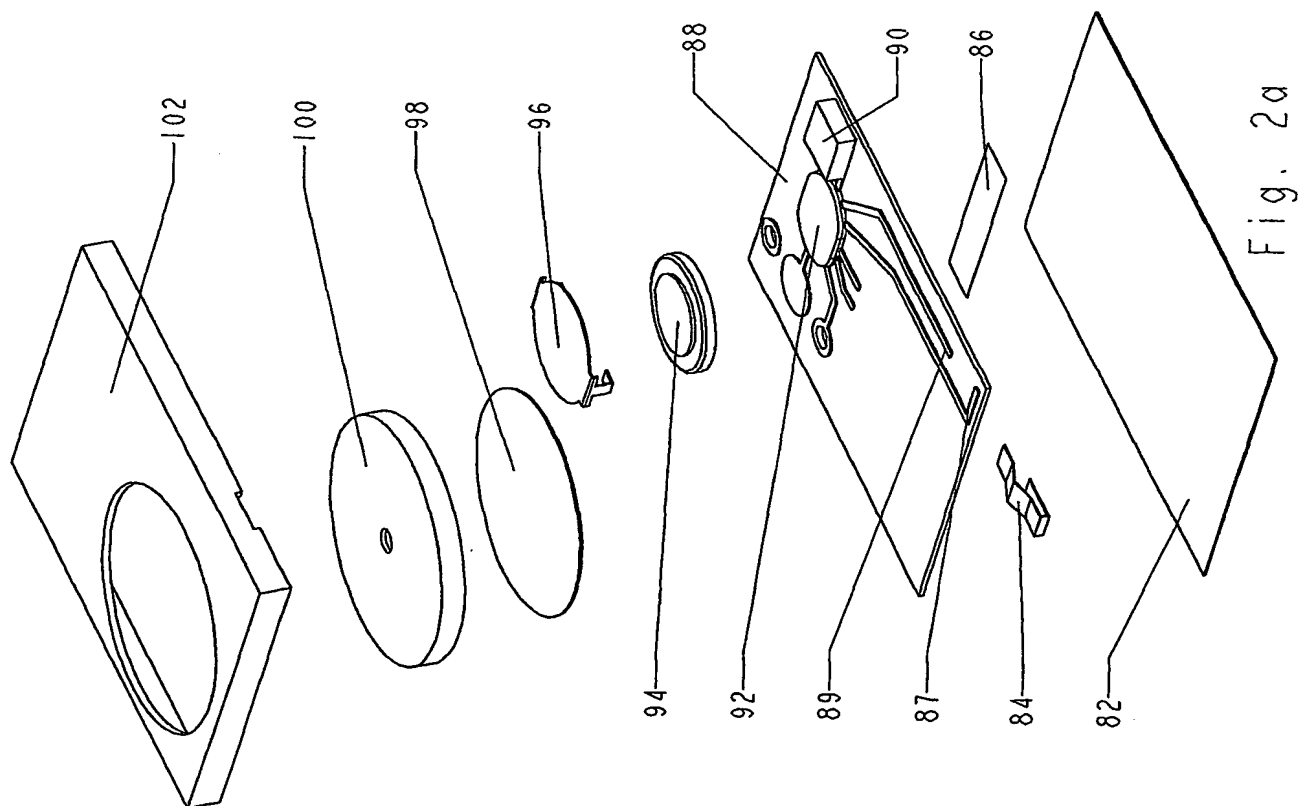
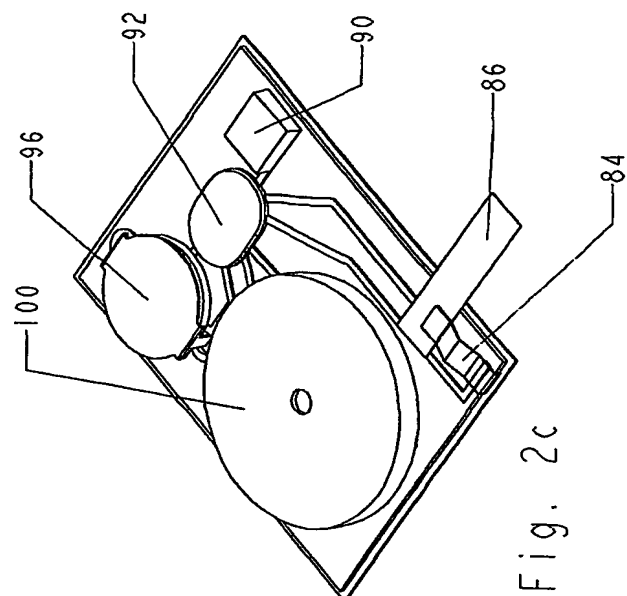
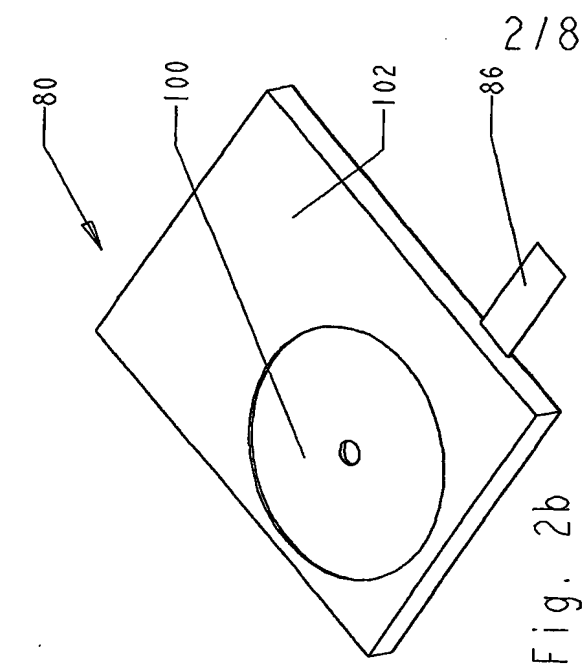


FIG. 1a





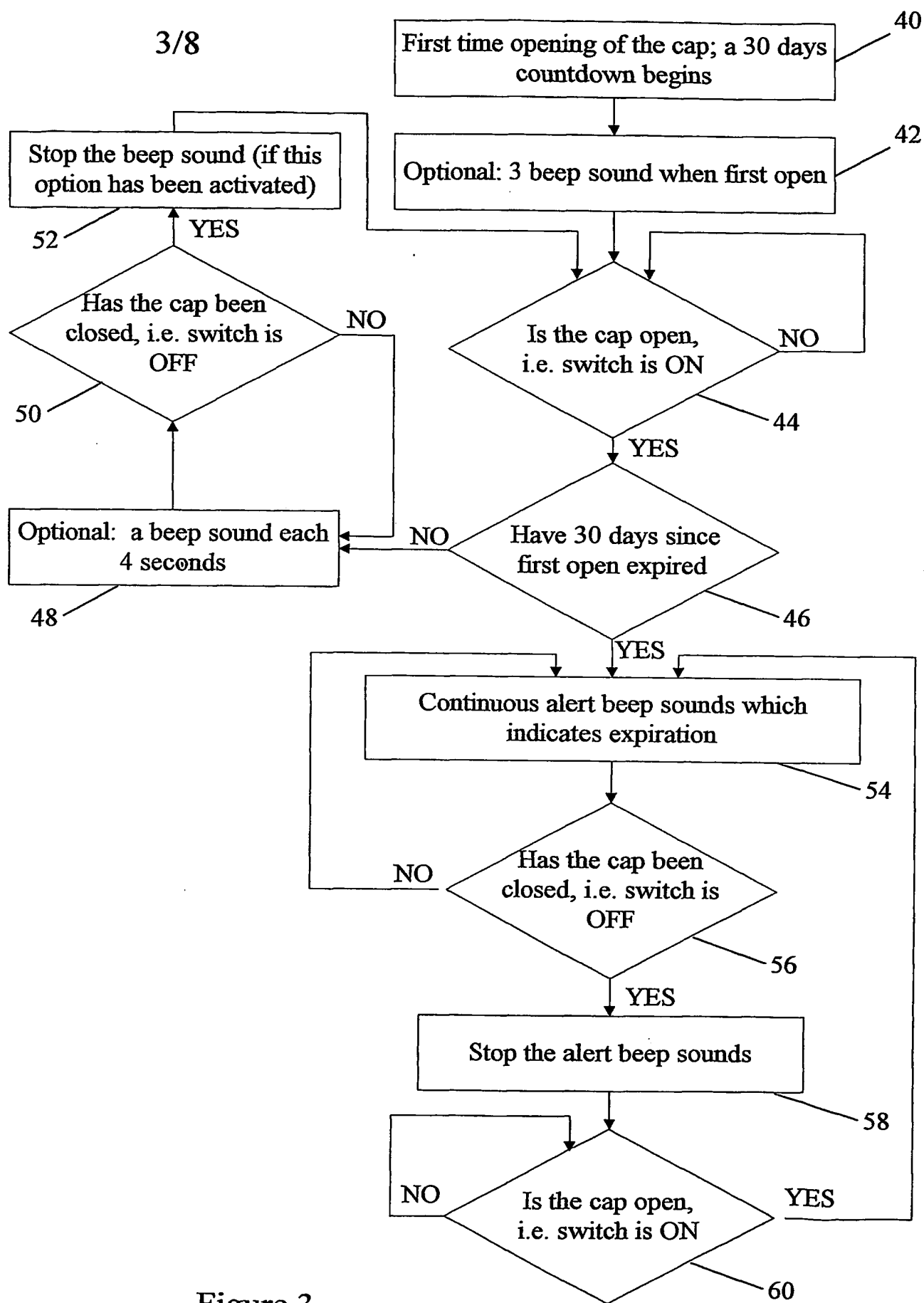
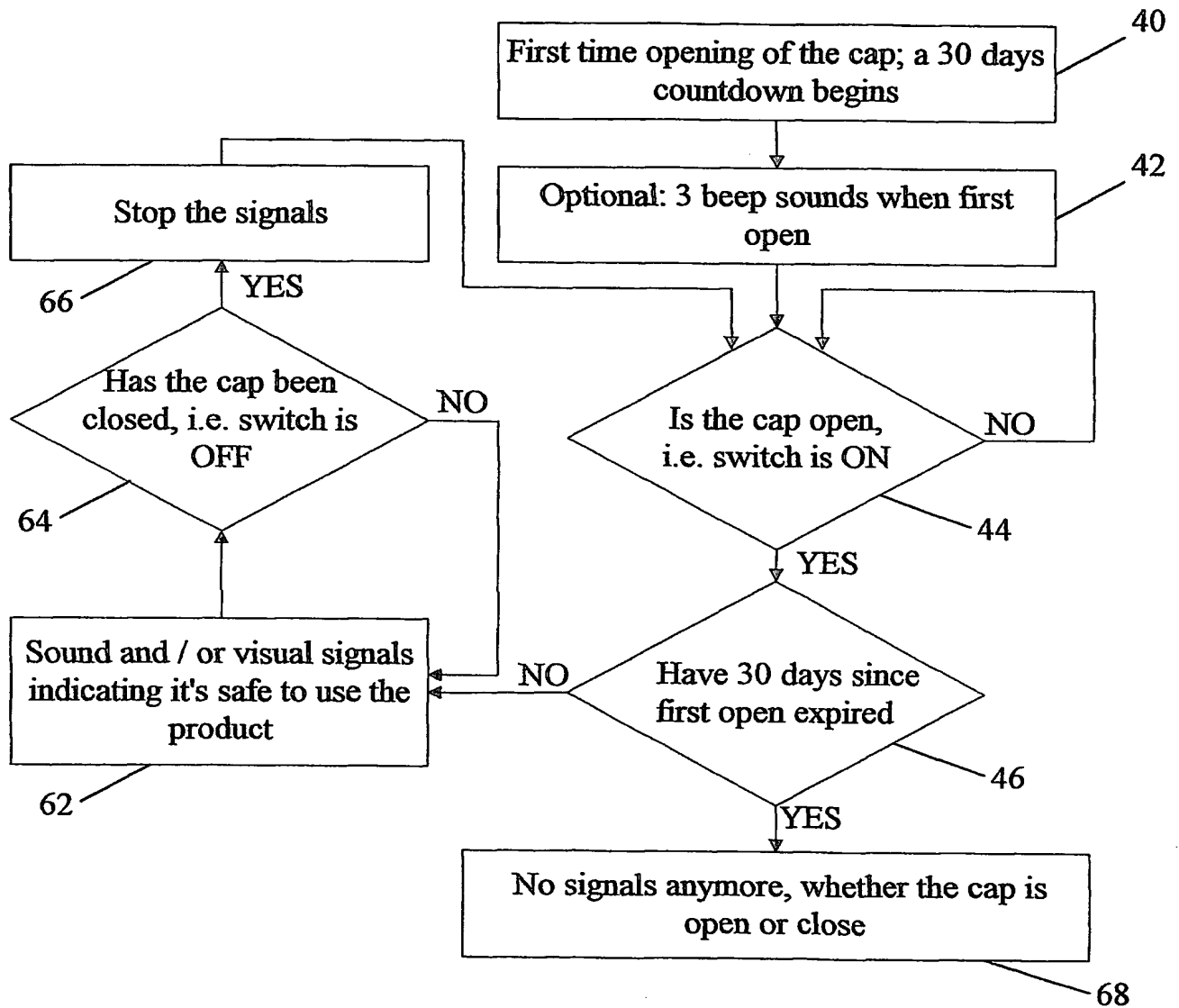


Figure 3

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Figure 4

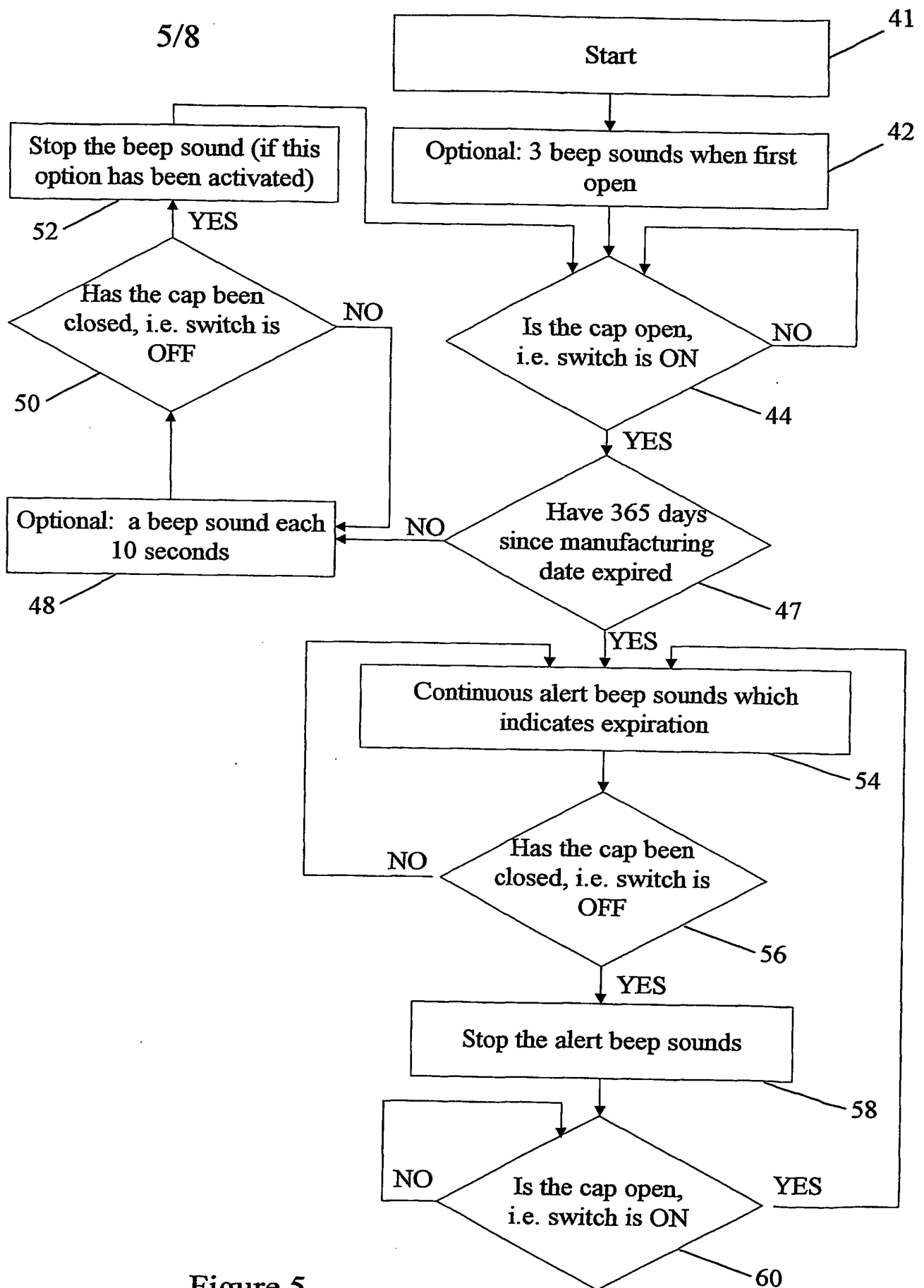
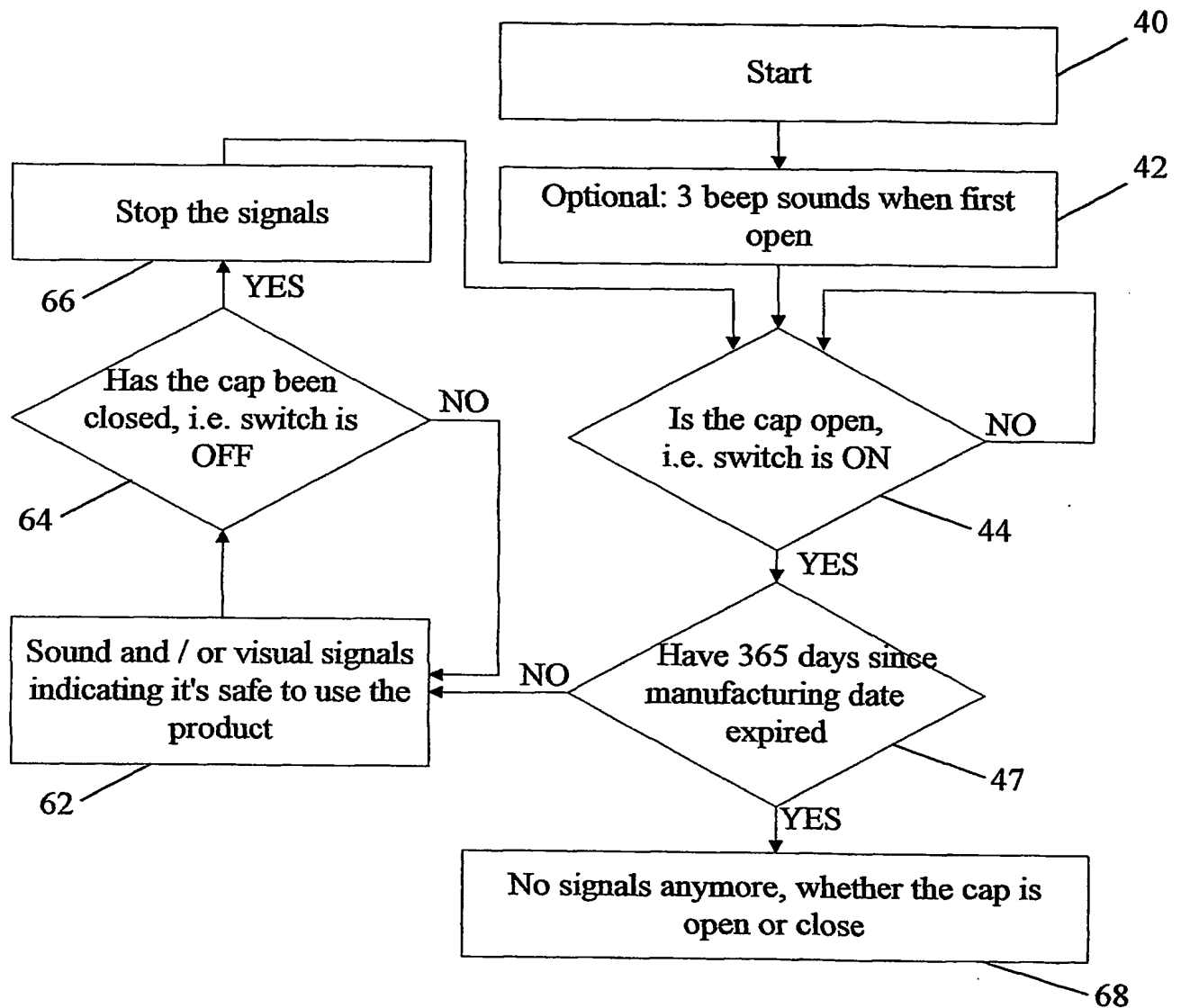


Figure 5

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Figure 6

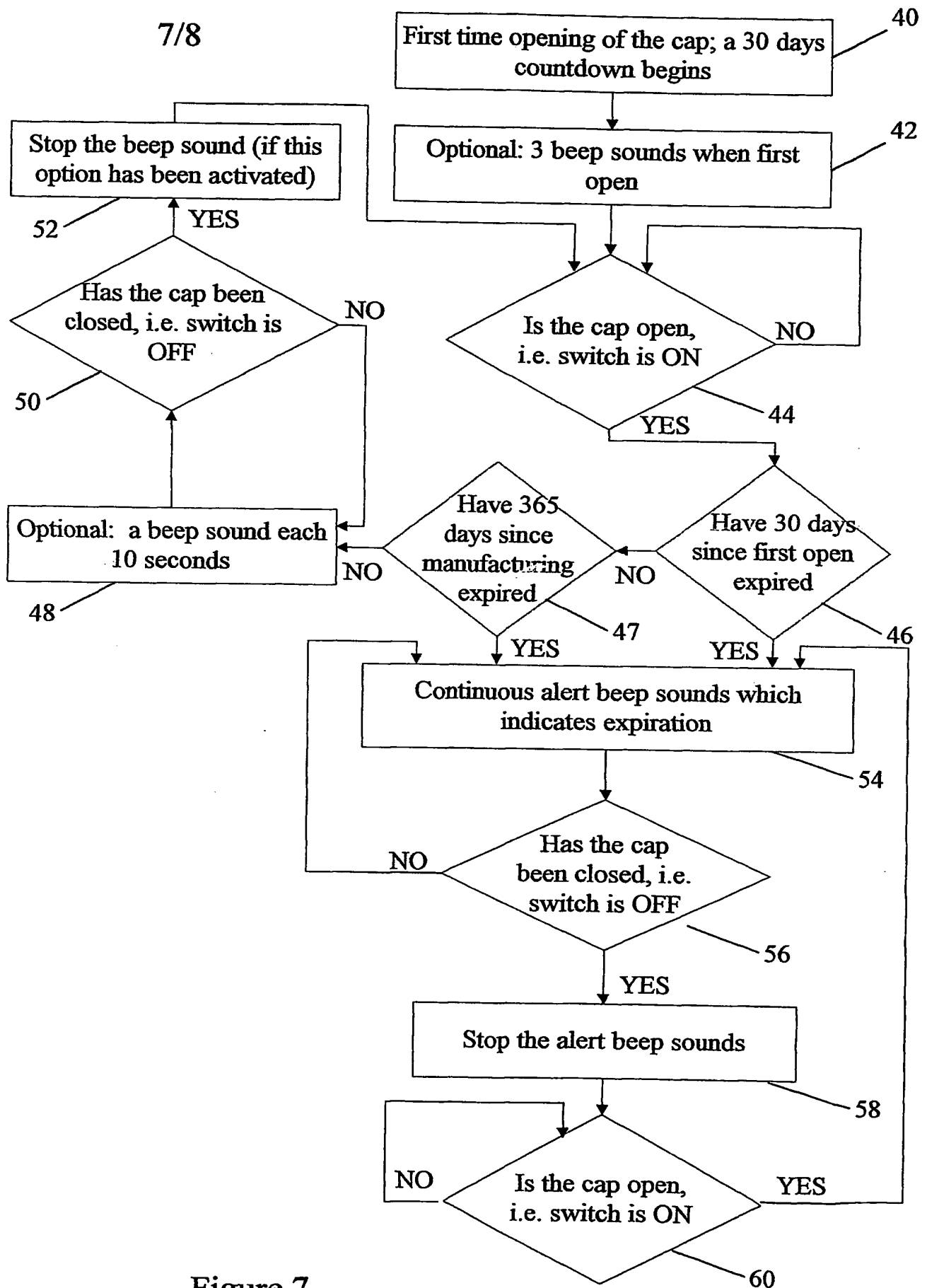
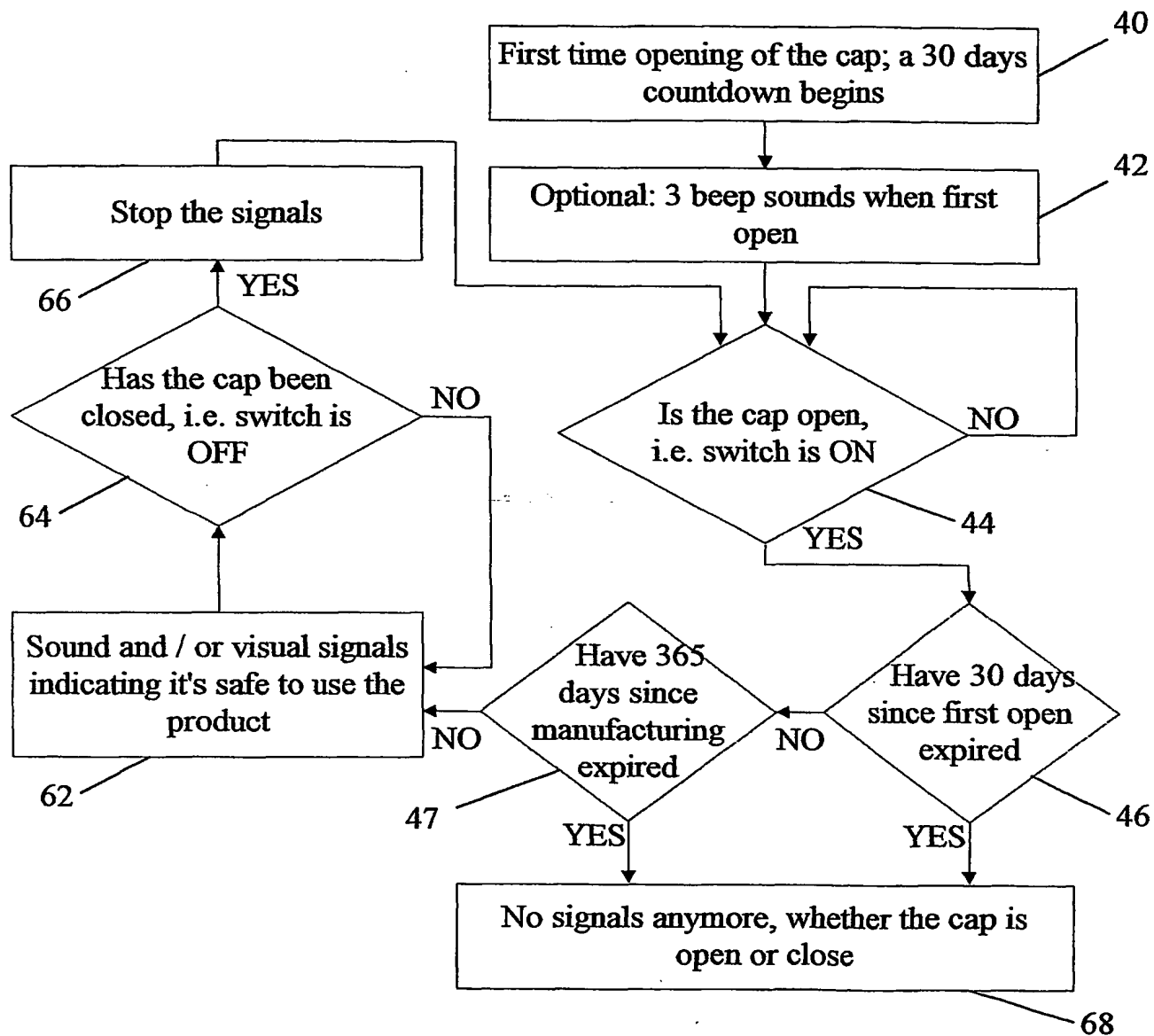


Figure 7

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Figure 8

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL04/00764

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G04B 47/00, G04F 10/00

US CL : 368/109, 368/10

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 368/109, 368/10, 368/89, 368/108, 368/113

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,852,590 B1 (de la HUERGA) 22 December 1998 (22.12.1998)	1-4, 14, 16-22
A,E	US 6,795,376 B2 (QUINE) 21 Septmeber 2004 (21.09.2004)	1-4, 14, 16-22
A	US 5,802,015 B1 (ROTHSCHILD et al) 01 September 1998 (01.09.1998)	1-4, 14, 16-22
A	US 5,711,160 (NAMISNIAK et al) 27 June 1998 (27.06.1998)	1-4, 14, 16-22
A	US 6,084,504 B1 (ROSCHE et al) 04 June 2000 (04.06.2000)	1-4, 14, 16-22
A	US 20020085453 A1 (FORTUNE) 04 June 2002 (04.06.2002)	1-4, 14, 16-22
A	US 20010036129 A1 (CARR) 01 November 2001 (01.11.2001)	1-4, 14, 16-22
A	US 4,849,948 B1 (DAVIS et al) 18 June 1989 (18.06.1989)	1-4, 14, 16-22
A	US 6,298,331 B1 (WALKER et al) 02 October 2001 (02.10.2001)	1-4, 14, 16-22

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search

15 April 2005 (15.04.2005)

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